Deer Valley Unified

School District

Mathematics Curriculum



Geometry Honors

**2009-2010**

|  |  |  |  |  |  |  |
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| **TOPIC: Tools of Geometry** | | | | | | Semester this  will be taught: 1 |
| **Enduring Understanding: Recognizing the relationship of points, lines, and planes and the geometric figures they form is the foundation for applying mathematics to the real world.** | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 1(CWR). Perform basic geometric constructions using a variety of methods, including   1. perpendicular bisector of a line segment, 2. bisector of an angle 3. perpendicular or parallel lines. |  | **1/1** | What is the distance and midpoint between two points?  How do angles relate to one another?  How do you identify congruent segments?  What is an angle bisector? Segment bisector?  What is the difference between a regular and irregular polygon?  What is a polyhedron? | 1.5 |  |
| **Strand 4: Geometry and Measurement**  **Concept 3: Coordinate Geometry** | PO 1. Determine how to find the midpoint between two points in the coordinate plane. |  | **1/1** | 1.3 |
| PO 3. Determine the distance between two points in the coordinate plane. |  | **1/1** | 1.3 |
| **Strand 4: Geometry and Measurement**  **Concept 4: Measurement** | PO 1. Use dimensional analysis to keep track of units of measure when converting. |  | **1/1** | 1.2 |
| PO 3. Determine the effect that changing dimensions has on the perimeter, area, or volume of a figure. |  | **1/1** | 1.6,1.7 |
| PO 5. Calculate the surface area and volume of 3-dimensional figures and solve for missing measures. |  | **1/1** | 1.7 |
| **Strand 5: Structure and Logic**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 1. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. |  | 1/1 | 1.4 |
| PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). |  | **1/1** | 1.5 |
| PO 4. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning. |  | **1/1** | 1.2 |
| PO 5. Calculate the surface area and volume of 3-dimensional figures and solve for missing measures. |  | **1/1** | 1.1 |
| PO 7. Find structural similarities within different algebraic expressions and geometric figures. |  | **1/1** | 1.6 |

**Key Concepts: Key Vocabulary:**

Equilateral, Equiangular

Perpendicular

Polygon, Polyhedron

Side, Edge, Base, Face

Midpoint, Distance

Concave, Convex

Point, Line, Plane, Ray

Interior, Exterior

Collinear, Coplanar

Cone, Cylinder, Prism, Pyramid, Sphere

Area, Perimeter, Circumference, Volume, Surface area

Bisector- Angle, Segment

Angles- Acute, Adjacent, Complementary, Obtuse, Right, Supplementary, Vertical

Supplementary angles are two angles with measures that have a sum of 180. (1.5)

Complementary angles are two angles with measures that have a sum of 90. (1.5)

A linear pair is a pair of adjacent angles with noncommon sides that are opposite rays. (1.5)

Vertical angles are two nonadjacent angles formed by two intersecting lines. (1.5)

Adjacent angles are two coplanar angles that lie in the same plane and have a common vertex and a common side but no common interior points. (1.5)

An angle is formed by two noncollinear rays that have a common endpoint, called its vertex. Angles can be classified by their measures. (1.4)

The distance and midpoint between two points in a coordinate system and on a number line. (1.3)

There is exactly one line through any two points. There is exactly one plane through any three noncollinear points. (1.1)

**Enduring Understanding:**

Recognizing the relationship of points, lines, and planes and the geometric figures they form is the foundation for applying mathematics to the real world.

TOPIC:

**Tools of Geometry**

**Essential Question(s):**

How do you find the distances between points and midpoints of line segments?

What are the different angle relationships?

How do you find perimeters, areas, surface areas, and volumes?

**Find the measure of if Q is the midpoint of  and .**

**Examples:**

**Solve for *a, given ***

Q





P

R

M

N





14

M

N

O

P

bisects , find .



A

B

C

D

E

Given: 

Prove: 

A

B

C

D

|  |  |  |  |  |  |  |  |
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| **TOPIC: Reasoning and Proof** | | | | | | | Semester this  will be taught: **1** |
| **Enduring Understanding: Recognizing the relationship of points, lines, and planes and the geometric figures they form is the foundation for applying mathematics to the real world.** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 3. Create and analyze inductive and deductive arguments concerning geometric ideas and relationships. |  | **1/1** | How do you find the distances between points and midpoints of line segments?  What are the different angle relationships?  How do you find perimeters, areas, surface areas, and volumes? |  | 2.1, 2.4 |  |
| **Strand 5: Structure and Logic**  **Concept 1: Algorithms and Algorithmic Thinking** | PO 2. Analyze algorithms for validity and equivalence recognizing the purpose of the algorithm. |  | **1/1** | 2.6 |
| PO 1(CWR). Use a variety of approaches (inductive and deductive reasoning, estimations, generalizations, formal and informal methods of proof) to analyze algorithms. |  | **1/1** | 2.1-2.8 |
| **Strand 5: Structure and Logic**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 5. Summarize and communicate mathematical ideas using formal and informal reasoning. |  | **1/1** | 2.7 |
| PO 8. Use inductive reasoning to make conjectures, use deductive reasoning to analyze and prove a valid conjecture, and develop a counterexample to refute an invalid conjecture. |  | **1/1** | 2.1, 2.2, 2.4 |
| PO 9. State the inverse, converse, and contrapositive of a given statement and state the relationship between the truth value of these statements and the original statement. |  | **1/1** | 2.3 |
| PO 11. Draw a simple valid conclusion from a given *if…then* statement and a minor premise. |  | **1/1** | 2.3 |
| PO 12. Construct a simple formal deductive proof. |  | **1/1** | 2.5, 2.6, 2.7, 2.8 |

**Key Concepts: Key Vocabulary:**

**Essential Question(s):**

How do you determine the validity if an argument or a conclusion?

Why is it important to use logical reasoning?

What is a counterexample used for?

Construct simple formal and informal deductive proofs. (2.5-2.8)

Deductive reasoning: Law of Detachment, Law of Syllogism (2.4)

Conjunction: a compound statement formed with the word *and* (2.1, 2.2)

Negation of statement *p: not p*

(2.1, 2.2)

The inverse, converse, contrapositive, and biconditional of a conditional statement can be true or false. A counterexample exists when a statement is false. (2.3)

An if-then statement is written in the form if *p*, then *q* in which *p* is the hypothesis and *q* is the conclusion. (2.3)

Disjunction: a compound statement formed with the word *or* (2.1, 2.2)

Counterexample: an example that proves a conjecture is false.

(2.1, 2.2)

Inductive reasoning: a conjecture is reached based on observations of a previous pattern. (2.1, 2.2)

**Enduring Understanding:**

Structure and logic are used daily to decipher and understand real world situations.

Proofs

Conditional statement

Counterexample

Biconditional

Converse/inverse

Theorem/postulate

Contrapositive

Hypothesis

Negation

Conjectures

Logical chain

TOPIC:

**Reasoning and Proof**

**Put the statements in logical order. Then write the conclusion for the logical chain.**

* If they get married, then they will set a date.
* If Donny asks Pam, then she will say yes.
* If she says yes, then they will get married.

**Examples:**

The following argument is an example of deductive reasoning:

***All humans are mortal.***

***Socrates is human.***

***Therefore, Socrates is mortal.***

**Write the converse, inverse, contrapositive, biconditional of the conditional statement and determine if the statements are true or false. If the statement is false, give a counterexample.**

1. Lions are cats that roar.
2. Supplementary angles have a sum of 180°.

Inductive/deductive reasoning

|  |  |  |  |  |  |  |  |
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| **TOPIC: Parallel and Perpendicular Lines** | | | | | | | Semester this  will be taught: **1** |
| **Enduring Understanding: Recognizing the relationship of points, lines, and planes and the geometric figures they form is the foundation for applying mathematics to the real world.** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 3: Patterns, Algebra and Functions**  **Concept 3: Algebraic Representations** | PO 4 Determine from two linear equations whether the lines are parallel, perpendicular, coincident or intersecting but not perpendicular |  | **1/1** | How do you identify relationships that occur with parallel lines and transversals and prove lines parallel from given angle relationships?  How do you use slope to analyze a line and to write its equation?  How do you find the distance between a point and a line and between two parallel lines? |  | 3.4 |  |
| **Strand 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 3 Create and analyze inductive and deductive arguments concerning geometric ideas and relationships. |  | **1/1** |  | 3.1 |  |
| PO 4 Apply properties, theorems, and constructions about parallel lines, perpendicular lines, and angles to prove theorems |  | **1/1** | 3.2. 3.5, 3.6 |
| PO 5 Explore Euclid’s five postulates in the p lane and their limitations. |  | **1/1** | 3.5 |

**Key Concepts: Key Vocabulary:**

Proving parallel lines are congruent. (3.5)

The distance from a line to a point not on the line is the length of the segment perpendicular to the line from the point. (3.6)

The distance between two parallel lines is the distance between one of the lines and any point on the other line. (3.6)

The slope of a line can be calculated using two points. (3.3, 3.4)

If two parallel lines are cut by a transversal, then: corresponding angles, alternate interior angles, alternate exterior angles are congruent. Consecutive interior angles are supplementary. (3.1, 3.2)

When a transversal intersects two lines, the following angles are formed: exterior, interior, consecutive interior, alternate interior, alternate exterior, and corresponding. (3.1, 3.2)

**Examples:**

Parallel lines

Parallel planes

Transversal

Interior angles

Exterior angles

Consecutive interior angles

Alternate interior angles

Alternate exterior angle

Corresponding angles

Slope/Rate of Change

Slope-Intercept Form

Point-Slope form

Equidistance

TOPIC:

**Parallel and Perpendicular Lines**

s

**Given: , , **

**Find *x*.**

m



2

4

3

1

6

8

7

5

Find the distance from the line to the point (-6, 5).

Various // line proofs, proving AIA, AEA, etc. and their converses.

Write an equation of a line passing through A(2, -5), // to with B(1, 3) and C(4, 5).





108°

120°

Find *x* and *y*.

**Essential Question(s):**

How do you identify relationships what occur with parallel lines and transversals and prove lines parallel from given angle relationships?

How do you use slope to analyze a line and to write its equation.

How do you find the distance between a point and a line and between two parallel lines?

**Enduring Understanding:**

Recognizing the relationships of points, lines, and planes and the geometric figures they form is the foundation for applying mathematics to the real world.

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| **TOPIC: Congruent Triangles** | | | | | | Semester this  will be taught: **1** |
| **Enduring Understanding: Apply special relationships about interior and exterior angles of triangles, identify corresponding parts of congruent triangles and prove triangles congruent, learn about the special properties of isosceles and equilateral triangles.** | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Quarter  **I/B** | **Essential Questions** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement** Concept 1: Geometric Properties | PO 3. Create and analyze inductive and deductive arguments concerning geometric ideas and relationships. |  | **1/1** | How can you determine whether or not two triangles are congruent?  How do we use properties of isosceles and equilateral triangles?  How do we test congruence of transformations of triangles?  How do we use coordinate geometry to write proofs? | 4.4 |  |
| PO 6. Solve problems using angle and side length relationships and attributes of polygons. |  | **1/1** | 4.1 |  |
| PO 8. Prove similarity and congruence of triangles. |  | **1/1** | 4.4 |  |
| PO 1(CWR). Perform basic geometric constructions using a variety of methods, including   1. perpendicular bisector of a line segment, 2. bisector of an angle 3. perpendicular or parallel lines. |  | **1/1** | 4.4, 4.5 |  |
| PO 4 Apply properties, theorems, and constructions about parallel lines, perpendicular lines, and angles to prove theorems |  |  | 4.4, 4.5 |  |
| **Strand 4: Geometry and Measurement**  **Concept 2: Transformations of Shapes** | PO 1. Determine whether a transformation of a 2-dimensional figure on a coordinate plane represents a translation, reflection, rotation, or dilation and whether congruence is preserved. |  | **1/1** | 4.7 |  |
| **Strand 4: Geometry and Measurement**  **Concept 3: Coordinate Geometry** | PO 4. Verify characteristics of a given geometric figure using coordinate formulas for distance, midpoint, and slope to confirm parallelism, perpendicularity, and congruence. |  | **1/1** | 4.8 |  |
| **Strand 5: Structure and Logic**  **Concept 2: Algorithms and Algorithmic Thinking** | PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). |  | **1/1** | 4.2 |  |
| PO 5. Summarize and communicate mathematical ideas using formal and informal reasoning. |  | **1/1** | 4.3 |  |
| PO 7. Find structural similarities within different algebraic expressions and geometric figures. |  | **1/1** | 4.2 |  |
| PO 12. Construct a simple formal deductive proof. |  | **1/1** | 4.3, 4.5, 4.6, 4.7, 4.8 |  |

**Key Concepts: Key Vocabulary:**

Acute triangle

Triangles can be classified by their angles as acute, obtuse, or right, and by their sides as scalene, isosceles, or equilateral. (4.1)

TOPIC:

**Congruent Triangles**

Auxiliary line

Base angle

The measure of an exterior angle is equal to the sum of its remote interior angles. (4.2)

Congruence transformation

Congruent triangles

**Enduring Understanding:**

Apply special relationships about interior and exterior angles of triangles,

identify corresponding parts of congruent triangles and prove triangles congruent, learn about the special properties of isosceles and equilateral triangles.

Coordinate proof

Determine whether or not two triangles are congruent using SSS, SAS, ASA, or AAS. (4.3-4.5)

Corollary

Corresponding parts

**Essential Question(s):**

How can you determine whether or not two triangles are congruent?

How do we use properties of isosceles and equilateral triangles?

How do we test congruence of transformations of triangles?

How do we use coordinate geometry to write proofs?

Construct a congruent triangle given a triangle using SSS, SAS, ASA, or AAS with a straightedge and compass. (4.3-4.5)

Equiangular triangle

Equilateral triangle

Exterior angle

**Examples:**

The base angles of an isosceles triangle are congruent and a triangle is equilateral if it is equiangular. (4.6)

**Are the triangles congruent? Write a proof to justify your answer.**

Flow proof

**Construct a triangle congruent to  using SSS, SAS, and ASA.**

A

C

B

3

5

30º

A

B

C

D

E

F

3

5

60º

Included angle

In a congruence transformation, the position of the image may differ from the preimage, but the two figures remain congruent. (4.7)

Included side

Isosceles triangle

**Find *x*.**

1. b)

b)





12

Obtuse triangle

Various triangle congruence proofs including SSS, ASA, etc. (Incorporate // lines and vertical angles)

5

2x+1

x+4

Coordinate proofs use algebra to prove geometric concepts. (4.8)

Reflection

Remote interior angles

**Find *x*.**

(8x)º

20º

Right triangle

(4x)º

Rotation

Scalene triangle



Vertex angle

(3x)º

Translation

|  |  |  |  |  |  |  |  |
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| **TOPIC: Relationships in Triangles** | | | | | | | Semester this  will be taught: **1** |
| **Enduring Understanding: You will learn about special segments and points related to triangles; about relationships between the sides and angles of triangles; and write an indirect proof.** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Quarter  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4 : Geometry and Measurement**  **Concept 1:Geometric Properties** | PO 3. Create and analyze inductive and deductive arguments concerning geometric ideas and relationships. |  | **1/1** | How do you determine if two triangles are congruent?  How do you order side lengths and angles from smallest to largest?  How do you identify if a triangle exists?  What are the points of concurrency in a triangle called? |  | 5.4 |  |
| PO 6. Solve problems using angle and side relationships and attributes of polygons. |  | **1/1** | 5.3  5.6 |
| PO 9. Solve problems using the triangle inequality property. |  | **1/1** | 5.5  Explore 5.5 |
| **Strand 5: Structure and Logic**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). |  | **1/1** | 5.5 |
| PO 12. Construct a simple formal deductive proof. |  | **1/1** | 5.1  5.2  5.3  5.4 |

**Key Concepts: Key Vocabulary:**

The special segments of triangles are perpendicular bisectors, angle bisectors, medians and altitudes. (5.1, 5.2)

TOPIC:

**Relationships in Triangles**

What are the minimum and maximum lengths of a piece of wood given the two other pieces of wood used to build a triangle are 24 ft and 7 ft?

**Examples:**

**Essential Question(s):**

How do you determine if two triangles are congruent?

How do you order side lengths and angles from smallest to largest?

How do you identify if a triangle exists?

What are the points of concurrency in a triangle called?

altitude

centroid

circumcenter

concurrent lines

incenter

indirect proof

indirect reasoning

median

orthocenter

perpendicular bisector

point of concurrency

proof by contradiction

congruent

SAS Inequality (Hinge Theorem): In two triangles, if two sides are congruent, then the measure of the included angle determines which triangle has the longer third side. (5.6)

The sum of the lengths of any two sides of a triangle is greater than the length of the third side (5.5)

The largest angle in a triangle is opposite the longest side, and the smallest angle is opposite the shortest side. (5.3)

SSS Inequality: In two triangles, if two corresponding sides of each triangle are congruent, then the length of the third side determines which triangle has the included angle with the greater measure. (5.6)

Writing and indirect proof:

1. Assume that the conclusion is false.
2. Show that this assumption leads to a contradiction.
3. Since the false conclusion leads to an incorrect statement, the original conclusion must be true. (5.4)

Find the value of x if the perimeter of a triangle is 27 and the side lengths are represented by, *x*+2, and *x*+7.

Q

2*z*

2*x* - 6

*y*

3

7

4

Find *x*, *y*, and *z* if Q is the centroid.

Find *x.*

25°

25°

3*x*+6

4*x* - 2

The points of concurrency for a triangle are the circumcenter, incenter, centroid, and orthocenter. (5.1, 5.2)

The intersection points of each of the special segments of a triangle are called the points of concurrency. (5.1, 5.2)

**Enduring Understanding:** You will learn about special segments and points related to triangles; about relationships between the sides and angles of triangles; and write an indirect proof.

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| **TOPIC: Quadrilaterals** | | | | | | | Semester this  will be taught:  **1** |
| **Enduring Understanding: The classification and exploration of quadrilaterals is essential to understanding physical relationships in the real world.** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 6. Solve problems using angle and side length relationships and attributes of polygons. |  | **1/1** | What is the relationship between the angles and number of sides in a polygon?  How do you calculate the measure of the interior and exterior angles of a polygon?  What is the hierarchy of quadrilaterals and what makes each element unique? |  | 6.1 |  |
| PO 7. Use the hierarchy of quadrilaterals in deductive reasoning |  | **1/1** | 6.5 |
| **Strand 4: Geometry and Measurement**  **Concept 3: Coordinate Geometry** | PO 4. Verify characteristics of a given geometric figure using coordinate formulas for distance, midpoint, and slope to confirm parallelism, perpendicularity, and congruence. |  | **1/1** | 6.2, 6.3 Exploration |
| **Strand 5: Structure and Logic**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). |  | **1/1** | 6.6 |
| PO 7. Find structural similarities within different algebraic expressions and geometric figures. |  | **1/1** | 6.5 |
| PO 12. Construct a simple formal deductive proof. |  | **1/1** | 6.2, 6.3, 6.4, 6.6 |

**Key Concepts: Key Vocabulary:**

The sum of the measures of the interior angles of a polygon is given by the formula:

S=180(n-2) (6.1)

Base

TOPIC:

**Quadrilaterals**

Trapezoid















Find the diagonals in ABCD.

Construct a rectangle using a compass and straight edge.

Construct a square using a straight edge and compass.

Find *x*



Find *x*.

**Essential Question(s):**

What is the relationship between the angles and number of sides in a polygon?

How do you calculate the measure of the interior and exterior angles of a polygon?

What is the hierarchy of quadrilaterals and what makes each element unique?

Properties of Parallelograms:

Opposite sides are congruent and parallel

Opposite angles are congruent.

Consecutive angles are supplementary.

If a parallelogram has one right angle, it has four right angles.

Diagonals bisect each other. (6.2, 6.3)

Properties of Rectangles, Rhombi, Squares, and Trapezoids.:

A rectangle has all the properties of a parallelogram. Diagonals are congruent and bisect each other. All four angles are right angles.

A rhombus has all the properties of a parallelogram. All sides are congruent. Diagonals are perpendicular. Each diagonal bisects a pair of opposite angles.

A square has all the properties of a parallelogram, a rectangle, and a rhombus.

In an isosceles trapezoid, both pairs of base angles are congruent and the diagonals are congruent.

The sum of the measures of the exterior angles of a convex polygon is 360. (6.1)

Square

Rhombus

Rectangle

Parallelogram

Midsegment of a Trapezoid

Legs

Kite

Isosceles Trapezoid

Diagonal

Base angle

**Examples:**

**Enduring Understanding:**

The classification and exploration of quadrilaterals is essential to understanding physical relationships in the real world.

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| **TOPIC: Proportions and Similarity** | | | | | | | Semester this  will be taught: **1** |
| **Enduring Understanding: The classifications and exploration of polygons is essential to understanding physical relationships in the real world.** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Standard 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 8. Prove similarity and congruence of triangles |  | **1/1** | How do you identify similar polygons and use ratios and proportions to solve problems?  How do you identify and apply similarity transformations?  How do you use scale models and drawings to solve problems? |  | 7.3 |  |
| **Standard 4: Geometry and Measurement**  **Concept 2 : Transformation of Shapes** | PO 1. Determine whether a transformation of a 2-dimensional figure on a coordinate plane represents a translation, reflections or dilation and whether congruence is preserved |  | **1/1** |  | 7.6 |  |
| **Standard 4: Geometry and Measurement**  **Concept 4: Measurement** | PO 1. Use dimensional analysis to keep track of units of measure when converting |  | **1/1** |  | 7.7 |  |
| PO 4. Solve problems involving similar figures using ratios and proportions |  | **1/1** | 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7 |

**Key Concepts: Key Vocabulary:**

For any numbers *a* and *c* and any nonzero numbers *b* and *d*, if and only if ad = bc. (7.1)

TOPIC:

**Proportions and Similarity**

Cross products

Scale factor

Scale model

Similar polygons

Similarity transformations

Two polygons are similar if and only if their corresponding angles are congruent and the measures of their corresponding side are proportional. (7.2, 7.3)

A scale model or scale drawing has lengths that are proportional to the corresponding lengths in the object it represents.(7.6, 7.7)

Two triangles are similar when each of the following are proportional in measure; perimeter, corresponding altitudes, corresponding angle bisectors, and their corresponding medians. (7.4, 7.5)

A midsegment of a triangle is parallel to one side of the triangle and its length is one-half the length of that side. (7.4, 7.5)

If a line is parallel to one side of a triangle and intersects the other two sides in distinct points, then it separates these sides into segments of proportional lengths. (7.4, 7.5)

Two triangles are similar if:

AA – two angles of one triangle are congruent to two angles of the other triangle.

SSS: the measures of the corresponding sides of two triangles are proportional

SAS: the measures of two sides of one triangle are proportional to the measures of two corresponding sides of another triangle and their included angles are congruent. (7.2, 7.3)

Is ~?

A

B

C







D

F

E







Solve for *x*



A

B

C

D

E

Given: // 

Prove: ~

**Enduring Understanding:**

The classifications and exploration of polygons is essential to understanding physical relationship in the real world.

**Essential Question(s):**

How do you identify similar polygons and use ratios and proportions to solve problems?

How do you identify and apply similarity transformations?

How do you use scale models and drawings to solve problems?

**Examples:**

Scale drawing

Scale

Reduction

Ratio

Proportion

Midsegment of a triangle

Enlargement

Dilation

|  |  |  |  |  |  |  |  |
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| **TOPIC: Right triangles and Trigonometry** | | | | | | | Semester this  will be taught: **2** |
| **Enduring Understanding:** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 6. Solve problems using angle and side length relationships and attributes of polygons. |  | **2/2** | How do we find missing sides and angles of a triangle?  What is the geometric mean of a triangle?  What are the properties of special right triangles?  What are the trigonometric ratios? |  | 8.2, 8.4 |  |
| PO 10. Solve problems using right triangles, including special triangles. |  | **2/2** | 8.3 |
| PO 11. Solve problems using the sine, cosine, and tangent ratios of the acute angles of a right triangle. |  | **2/2** | 8.4, 8.5 |
| PO 3(CWR). Apply the law of cosines and the law of sines to find missing sides and angles of triangles. |  | **2/2** | 8.6 |
| **Strand 4: Geometry and Measurement**  **Concept 3: Coordinate Geometry** | PO 2. Illustrate the connection between the distance formula and the Pythagorean Theorem. |  | **2/2** | 8.2 Exploration |
| PO 4. Verify characteristics of a given geometric figure using coordinate formulas for distance, midpoint, and slope to confirm parallelism, perpendicularity, and congruence. |  | **2/2** | 8.2 Extension |
| **Strand 5: Structure and Logic**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 1. Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made. |  | **2/2** | 8.2 |
| PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). |  | **2/2** | 8.1-8.6 |
| PO 4. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning. |  | **2/2** | 8.3 |
| PO 12. Construct a simple formal deductive proof. |  | **3/3** | 8.1, 8.2 Extension, 8.6 |

**Key Concepts: Key Vocabulary:**

An angle of elevation is the angle formed by a horizontal line and the line of sight to an object above. An angle of depression is the angle formed by a horizontal line and the line of sight to an object below. (8.5)

The Law of Sines and the Law of Cosines. (8.6)

The measures of the sides of a 45°-45°-90° triangle are x, x, and x. (8.3)

The measures of the sides of a 30°-60°-90° triangle are x, 2x, and x. (8.3)

Trigonometry

Trigonometric ratio

Standard position

Resultant

Pythagorean triple

Law of Sines, Law of Cosines

Inverse cosine, Inverse sine, Inverse tangent

Geometric mean

Component form

Angle of elevation

Magnitude, Vector, Direction

Angle of depression

Let triangle ABC be a right triangle with right angle C. Then a2 + b2 = c2. (8.2)

For two positive numbers a and b, the geometric mean is the positive number x where a: x = x: b is true. (8.1)

Cosine, Sine, Tangent

TOPIC:

**Right Triangles and Trigonometry**

**Enduring Understanding:**

Attributes and properties of triangles are fundamental to our understanding of Trigonometry and other branches of Geometry.

Find  in the triangle w/ vertices

X(4, 1), Y(-6, 3), Z(-2, 7).

Solve if *a* = 15, *b* = 12, *c* = 13.

Find the geometric mean between  and 60.

Determine if is acute, right, or obtuse given the vertices

X(-7, -3), Y(-2, -5), Z(-4, -1).

**Examples:**

**Essential Question(s):**

How do you use the Pythagorean Theorem?

What are the properties of special right triangles?

How do you use trigonometry to find missing measures of triangles?

(8.4)



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| **TOPIC: Transformations and Symmetry** | | | | | | Semester this  will be taught: **2** |
| **Enduring Understanding: A clear understanding of transformations allows students to visualize the movement of objects in space and on a plane.** | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement**  **Concept 2: Transformation of Shapes** | PO 1. Determine whether a transformation of a 2-dimensional figure on a coordinate plane represents a translation, reflection, rotation, or dilation and whether congruence is preserved. |  | **2/2** | What is the difference between rigid and non-rigid transformations?  Given an image and a pre-image, describe the transformation.  What is the motion rule given the pre-image of a figure? | 9.1, 9.2, 9.3, 9.4, 9.6 |  |
| PO 2. Determine the new coordinates of a point when a single transformation is performed on a 2-dimensional figure. |  | **2/2** | 9.1, 9.2, 9.3, 9.6 |  |
| PO 3. Sketch and describe the properties of a 2-dimensional figure that is the result of two or more transformations. |  | **2/2** | 9.4 |  |
| PO 4. Determine the effects of a single transformation on linear or area measurements of a 2-dimensional figure. |  | **2/2** | 9.3 |  |
| **Strand 5: Structure and Logic**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 5. Summarize and communicate mathematical ideas using formal and informal reasoning. |  | **2/2** | 9.5 |  |
| PO 12. Construct a simple formal deductive proof. |  | **2/2** | 9.5 |  |

**Key Concepts: Key Vocabulary:**

Angle of rotation

TOPIC:

**Transformations**

A reflection is a transformation representing a flip of a figure over a point, line, or plane. (9.1)

Center of rotation

**Enduring Understanding:**

A clear understanding of transformations allows students to visualize the movement of objects in space and on a plane.

A translation is a transformation that moves all points of a figure the same distance in the same direction. (9.2)

Composition of transformations

A translation maps each point to its image along a translation vector. (9.2)

Glide reflection

**Essential Question(s):**

What is the difference between rigid and non-rigid transformations?

Given an image and a pre-image, describe the transformation.

What is the motion rule given the pre-image of a figure?

Line of reflection

A rotation turns each point in a figure through the same angle about a fixed point. (9.3)

Line of symmetry

A translation can be represented as a composition of reflections in parallel lines and a rotation can be represented as a composition of reflections in intersecting lines. (9.4)

**Examples:**

**Given the following coordinates: A(2, 5) B(4, 2) C(9, 6); apply the following transformation rules.**

a) (x, y) (x – 3, y + 2)

b) (x, y) (-x, y )

c) (x, y) (-x, -y)

d) (x, y) (2x, 2y)

What is the image of R(-3, 2) when translated 2 units to the left and 5 units down, then reflect across the line ?

Line symmetry

The line of symmetry in a figure is a line where the figure could be folded in half so that the two halves match exactly. (9.5)

Magnitude of symmetry

Order of symmetry

What is the image of R(-3, 2) when rotated -90° about the origin?

Plane symmetry

The number of times a figure maps onto itself as it rotates from 0°-360° is called the order of symmetry. (9.5)

What is the Preimage of R’(-3, 2) with scale factor *r* = 2?

Rotational symmetry

What single transformation yields the same result as reflecting an object across the *x*-axis, then across the *y*-axis?

Symmetry

The magnitude of symmetry is the smallest angle through which a figure can be rotated so that it maps onto itself. (9.5)

Translation vector

Dilations enlarge or reduce figures proportionally. (9.6)

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| **TOPIC: Circles** | | | | | | Semester this  will be taught: **2** |
| **Enduring Understanding: Circles and the relationships of angles, arcs, and segments help us to understanding the world around us.** | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 1. Use the basic properties of a circle (relationships between angles, radii, intercepted arcs, chords, tangents, and secants) to prove basic theorems and solve problems. |  | **2/2** | How do you represent major and minor arcs?  Why is it important to find lengths of arcs?  Why is the position of the vertex important to calculating the measures of angles formed by a combination of secants, tangents, and chords?  What is pi? | 10.1, 10.2, 10.3, 10.4, 10.510.6, 10.7 |  |
| **Strand 4: Geometry and Measurement**  **Concept 3: Coordinate Geometry** | ***PO 2(CWR). Determine an equation of a circle given its center and radius; given an equation of a circle, find its center and radius.*** |  | **2/2** | 10.8 |  |
| **Strand 4: Geometry and Measurement**  **Concept 4: Measurement** | PO 2. Find the length of a circular arc; find the area of a sector of a circle. |  | **2/2** | 10.2 |  |
| **Strand 5: Structure and Logic**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). |  | **2/2** | 10.5 |  |
| PO 4. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning. |  | **2/2** | 10.3 |  |
| PO 5. Summarize and communicate mathematical ideas using formal and informal reasoning. |  | **2/2** | 10.8 |
| PO 7. Find structural similarities within different algebraic expressions and geometric figures. |  | **2/2** | 10.1 |  |
| PO 12. Construct a simple formal deductive proof. |  | **2/2** | 10.4, 10.6, 10.8 |  |

**Key Concepts: Key Vocabulary:**

The circumference of a circle is πd or 2πr. (10.1)

The sum of the measures of the central angles of a circle 360°. (10.2-10.4)

The length of an arc is proportional to the length of the circumference. (10.2-10.4)

Diameters perpendicular to chords bisect chords and intercepted arcs. (10.2-10.4)

The measure an inscribed angle is half of its intercepted arc. (10.2-10.4)

A line that is tangent to a circle intersects the circle in exactly one point and is perpendicular to a radius. (10.5-10.6)

TOPIC:

**Circles**

**Enduring Understanding:**

Circles and the relationships of angles, arcs, and segments help us to understanding the world around us.

**Essential Question(s):**

How do you represent major and minor arcs?

Why is it important to find lengths of arcs?

Why is the position of the vertex important to calculating the measures of angles formed by a combination of secants, tangents, and chords?

What is pi?

**Examples:**

, , , 

1. Solve for *x*.
2. Find.

Circumference

Circumscribed

Tangent/common tangent

Compound locus

Concentric circles

Congruent arcs/circles

Diameter

External segment

Central angle

Chord/chord segment

Circle/semicircle

Arc/adjacent arcs

Center

Identify one of each of the following:

1. Radius
2. Diameter
3. Chord (not the diameter)
4. Secant Line
5. Point of tangency
6. Tangent Line
7. Central angle
8. Inscribed angle
9. Exterior angle
10. Interior angle
11. Major arc
12. Minor arc
13. Semicircle
14. Center

Inscribed/inscribed angle

Intercepted arc

**Use the picture for all examples.**

B

A

4

3

2

1

G

F

E

D

O

C

K

J

I

H

12

7

6

5

11

10

9

8

Two segments tangent to a circle from the same exterior point are congruent. (10.5-10.6)

The measure of an angle formed by two secant lines is half the positive difference of its intercepted arcs. (10.5-10.6)

The measure of an angle formed by a secant and a tangent line is half its intercepted arc. (10.5-10.6)

Minor/major arc

Pi(π)

Given , , .

1. Find arcs IJ, BD, EF, GF
2. Find angles 1 -12.

Point of tangency/tangent

The length of intersecting chords in a circle can be found by using the products of the measures of the segments. (10.7-10.8)

Radius

Find the equation of a circle whose diameter has endpoints at (0, 4) and (6, -4).

Secant/secant segment

The equation of a circle with center

(*h*, *k*) and radius *r* is

. (10.7-10.8)



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| **TOPIC: Areas of Polygons and Circles** | | | | | | | Semester this  will be taught: **2** |
| **Enduring Understanding:** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement.**  **Concept 4: Measurement** | PO 2. Find the length of a circular arc; find the area of a sector of a circle. |  | **2/2** | How do you find the areas of polygons?  How do you find the areas and sectors of circles?  How do you find the scale factors using similar figures? |  | 11-3 |  |
| PO 3. Determine the effect that changing dimensions has on the perimeter, area, or volume of a figure. |  | **2/2** | 11-4, 11-5 |  |
| **Strand 5: Structure and Logic.**  **Concept 2: Logic, Reasoning, Problem Solving, and Proof** | PO 2. Solve problems by formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s). |  | **2/2** | 11-3 |  |
| PO 4. Generalize a solution strategy for a single problem to a class of related problems; explain the role of generalizations in inductive and deductive reasoning. |  | **2/2** | 11-5 |  |
| PO 7. Find structural similarities within different algebraic expressions and geometric figures. |  | **2/2** | 11-1, 11-2 |  |

**Key Concepts: Key Vocabulary:**

If two polygons are similar, then their areas are proportional to the square of the scale factor between them. (11.5)

The area A of a regular n-gon with side length s is one half the product of the apothem a and the perimeter P. (11.4)

The ratio of the area A of a sector to the area of the whole circle, πr2, is equal to the ratio of the degree measure of the intercepted arc *x* to 360°. (11.3)

The area A of a circle is equal to π times the square of the radius r. (11.3)

The area A of a rhombus or kite is one half the product of the lengths of its diagonals, d1 and d2. (11.2)

The area A of a trapezoid is one half the product of the height h and the sum of its bases, b1 and b2.(11.2)

The area A of a triangle is one half the product of a base b and its corresponding height h. (11.1)

The area A of a parallelogram is the product of a base b and its corresponding height h. (11.1)

Radius of a regular polygon

Center of a regular polygon

Sector of a Circle

Height of a trapezoid

Height of a triangle

Base of a triangle

Height of a Parallelogram

Base of a Parallelogram

TOPIC:

**Areas of Polygons and Circles**

Apothem of a polygon

**Enduring Understanding:**

The classification and exploration of the areas of polygons and circles is essential to understanding physical relationships in the real world.

**Examples:**

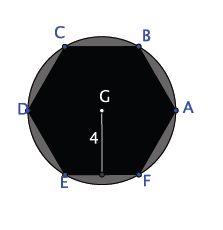
**Essential Question(s):**

How do you find the area of a polygon?

How do you solve problems involving area and sectors of circles?

How do you find scale factors using similar figures?

Find the area of the shaded region; leave your answer in terms of π.



The area of a rectangle is 84 square units and the width is 8 units more than the length. Find the perimeter.

Central angle of a regular polygon

Find the area of the shaded region; leave your answer in terms of π.

Find the area of the quadrilateral w/ vertices

A(-8, 6), B(-5, 8), C(-2, 6), D(-5, 0).

12

A

B

C

D

Composite figure

Find the area of an octagon w/ side length 4.3.

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| **TOPIC: Extending Surface Area and Volume** | | | | | | | Semester this  will be taught: **2** |
| **Enduring Understanding: Visualizing and determining the surface area and volume of various solid figures.** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Semester  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 4: Geometry and Measurement**  **Concept 1: Geometric Properties** | PO 2 Visualize solids and surfaces in 3-dimensional space when given 2-dimensional representation and create 2-dimensional representation for the surfaces of 3 dimensional objects. |  | **2/2** | How do you find lateral areas, surface areas, and volumes of various solid figures?  How do you investigate Euclidean and spherical geometries?  How do you use properties of similar solids? |  | Explore 12-1  12.1, 12.7 |  |
| PO 5 Explore Euclid’s five postulates in the plane and their limitations. |  |  | 12.7 |
| **Strand 4: Geometry and Measurement**  **Concept 4: Measurement** | PO 3 **Determine the effect that changing dimensions has on the perimeter**, area, and volume of a figure. |  | **2/2** | 12.2, 12.3, 12.4, Extend 12.4, 12.5,12.6, 12.8 |
| PO 5 Calculate the surface area and volume of 3-dimensional figures and solve for missing measures. |  |  |

**Key Concepts: Key Vocabulary:**

Solids can be classified by bases, faces, edges and vertices. (12.1)

Altitude

TOPIC:

**Extending Surface Area and Volume**

**Examples:**

Congruent solids and similar solids with a scale factor of 1. (12.8)

Surface Area of a Cylinder: 2πr2+2πrh

(12.2)

Surface Area of a Prism: 2B+Ph

(12.2)

Spherical Geometries

Euclidean Geometries

Slant height

Solids

Cylinder

Cone

Pyramid

Prism

Lateral edge

Lateral area

Composite solid

Base edges

**Enduring Understanding:**

Visualizing and determining the surface area and volume of various solid figures.

Surface Area of a Pyramid: B+P*l*



(12.3)

**Essential Question(s):**

How do you find lateral areas, surface areas and volumes of various solid figures?

How do you investigate Euclidean and spherical geometries?

How do you use Properties of similar solids?

Surface Area of Cone: πr*l*+πr2

(12.3)

Volume of Pyramid: Bh



Cones: πr2h (12.5)



How much room is left in the cube when the sphere is placed inside?

10 cm

Find the surface area of a cone whose volume is 144π m2 and height is equal to its diameter.

Volume of Prism: Bh

Cylinders: πr2h

(12.4)

Surface Area Sphere: 4πr2

Volume of Spheres: πr3



(12.6)

Find the surface area and volume of a sphere with diameter 7 in.

Find the volume and surface area of a hexagonal based pyramid with base edge 12 m and height 6 m.

Similar solids have the same shape, but not necessarily the same size. (12.8)

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| **TOPIC: Probability and Measurement** | | | | | | | Semester this  will be taught: **2** |
| **Enduring Understanding: Probability helps us make decisions and predict future outcomes.** | | | | | | |
| **Standard and**  **Related Concept** | **Performance Objectives** | **EIN** | Quarter  **I/B** | **Essential Questions** | **Assessments** | **Resources**  Ch=Chapter  L=Lesson | **Collaboration and Integration** |
| **Strand 2: Data Analysis, Probability, and Discrete Mathematics**  **Concept 2: Probability** | PO 1. Make predictions and solve problems based on theoretical probability models. |  | **2/2** | How is probability used to make predictions?  How can the probability of an event or events be determined?  How many ways can elements in a set be arranged? |  | 13.5  13.6 |  |
| PO 2. Determine the theoretical probability of events, estimate probabilities using experiments, and compare the two. |  | **2/2** | 13.4 |
| PO 3. Use simulations to model situations involving independent and dependent events. |  | **2/2** | 13.4 |
| PO 5. Use concepts and formulas of area to calculate geometric probabilities. |  | **2/2** | 13.3 |
| **Strand 2: Data Analysis, Probability and Discrete Mathematics**  **Concept 3: Systematic Listing and Counting** | PO 2. Apply appropriate means of computing the number of possible arrangements of items using permutations where order matters, and combinations where order does not matter. |  | **2/2** | 13.2 |
| PO 3. Determine the number of possible outcomes of an event. |  | **2/2** | 13.1  13.2 |
| **Strand 2: Data Analysis, Probability and Discrete Mathematics**  **Concept 4: Vertex-Edge Graphs** | PO 1. Determine the number of possible outcomes of an event. |  | **2/2** | Extend 13.6 |

**Key Concepts: Key Vocabulary:**

The number of possibilities available for an event can be established using charts, tree diagrams, or one of the counting principles. (13.1)

Geometric probability involves geometric measures such as length and area. (13.3)

* The class of 18 students will be arranged in groups of 3. How many different groups can be made? Solution: 

A bag of colored marbles is held by the teacher. The teacher drew a blue marble and handed it to a student in the first row. The teacher then drew a red marble and gave it to a student in the second row. What was the theoretical probability of the simulation? Model this probability using two different representations.

**Enduring Understanding:**

Probability helps us make decisions and predict future outcomes.

Counting principle

Simulation

Compound eents

Dependent event

Independent event

Permutations

Combinations

Factorial

Geometric probability

Tree diagram

Conditional probability

Mutually exclusive

Sample space

TOPIC:

**Probability**

In a permutation order is important.

In a combination order is not important.

(13.2)

**Essential Question(s):**

How is probability used to make predictions?

How can the probability of an event or events be determined?

How many ways can elements in a set be arranged?

A simulation is the use of a probability model to recreate a situation again and again so likelihood can be estimated. (13.4)

**Examples:**

If you choose a point in the rectangle, what is the probability that it is the shaded region?



The basic concepts of probability, both with and without replacements effect the outcome of an event. (13.5- 13.6)

A box contains *“n”* different objects. If you remove 3 from the box, one at a time w/o replacement, how many possible outcomes exist? Explain your answer.